

We claim:

1. A four-stroke cycle, four-cylinder reciprocating internal combustion engine having a crankshaft, four pistons, each reciprocal within a corresponding one of the cylinders, an intake poppet valve and an exhaust poppet valve for each cylinder, an intake camshaft for operating the intake valves, and an exhaust camshaft for operating the exhaust valves, the exhaust camshaft having primary lobes, each primary lobe normally opening the corresponding exhaust valve during an exhaust stroke of the corresponding piston, wherein:

the engine has an undivided exhaust manifold; and

the exhaust camshaft has secondary lobes, each secondary lobe opening the corresponding exhaust valve near an end of an intake stroke of the corresponding piston, whereby a pressure pulse in the exhaust manifold causes a portion of the exhaust gases to recirculate from the exhaust manifold and into the corresponding cylinder.

2. The engine of claim 1, further comprising:

means for closing the intake valve slightly earlier than normal.

3. The engine of claim 1, further comprising:

means for closing the intake valve slightly before the exhaust valve is closed by the secondary lobe.

4. A four-stroke cycle, four-cylinder reciprocating internal combustion engine having a crankshaft, four pistons, each reciprocal within a corresponding one of the cylinders, an intake poppet valve and an exhaust poppet valve for each cylinder, an intake camshaft for operating the intake valves, and an exhaust camshaft for operating the exhaust valves, the exhaust camshaft having primary lobes, each primary lobe normally opening the corresponding exhaust valve during an exhaust stroke of the corresponding piston, wherein:

the engine has an undivided exhaust manifold;

the exhaust camshaft has secondary lobes, each secondary lobe opening the corresponding exhaust valve near an end of an intake stroke of the corresponding piston, whereby a pressure pulse in the exhaust manifold causes a portion of the exhaust gases to recirculate from the exhaust manifold and into the corresponding

cylinder; and

the intake camshaft closes the intake valve slightly before the exhaust valve is closed by the secondary lobe.

5. In a four-stroke cycle, four-cylinder reciprocating internal combustion engine having a crankshaft, four pistons, each reciprocal within a corresponding one of the cylinders, an intake poppet valve and an exhaust poppet valve for each cylinder, an intake camshaft for operating the intake valves, and an exhaust camshaft for operating the exhaust valves, the exhaust camshaft having primary lobes, each primary lobe normally opening the corresponding exhaust valve during an exhaust stroke of the corresponding piston, a method for internally recirculating exhaust gases, the method comprising:

communicating exhaust gasses from the cylinders to an undivided exhaust manifold; and

re-opening the exhaust valve near an end of an intake stroke of the corresponding piston, and allowing a pressure pulse in the exhaust manifold to cause a portion of the exhaust gases in the exhaust manifold to recirculate back into the corresponding cylinder.

6. The method of claim 5, further comprising:

closing the intake valve slightly before the exhaust valve is closed by the secondary lobe.